

REMARKS

Applicant requests favorable reconsideration and allowance of the subject application in view of the preceding amendments and the following remarks.

To place the subject application in better form, the specification has been amended to correct minor informalities. Also, a new abstract is presented in accordance with preferred practice. No new matter has been added by these changes.

The drawings have been objected to in that Fig. 9 should be labeled as prior art. A replacement sheet for Fig. 9 with a prior art label is submitted. Approval of the replacement sheet is respectfully requested.

Claims 11-19 are presented for consideration in lieu of claims 1-10, which have been canceled without prejudice or disclaimer. Claims 11 and 16 are independent. Support for these claims can be found in the original application, as filed. Therefore, no new matter has been added.

Applicant requests favorable reconsideration and withdrawal of the rejections set forth in the above-noted Office Action.

Cancelled Claims 1-3 and 5-10 were rejected under 35 U.S.C. § 102 as being anticipated by U.S. Patent No. 5,894,341 to Nishi et al. Cancelled Claim 4 was rejected under 35 U.S.C. § 103 as being unpatentable over the Nishi et al. patent in view of U.S. Patent No. 6,744,492 to Takahashi et al. Applicant submits that the cited art, whether taken individually or in combination, does not teach many features of the present invention, as previously recited in cancelled independent claims 1 and 8. Therefore, these rejections are respectfully traversed. In

addition, Applicant submits that independent claims 11 and 16, for example, as presented, amplify the distinctions between the present invention and the cited art.

In one aspect of the present invention, new independent claim 11 recites an exposure apparatus which has a light source and transfers a pattern of an original to a substrate using light supplied from the light source. In the apparatus, a photoelectric sensor used to control an amount of light to which the substrate is exposed. A memory stores a first value for correcting an output value of the photoelectric sensor with respect to each accumulated energy of light having a first power with which the photoelectric sensor is irradiated. A calculator calculates a second value for correcting an output value of the photoelectric sensor corresponding to a second accumulated energy of light having a second power with which the photoelectric sensor is irradiated based on the first value in the memory corresponding to the second accumulated energy and a ratio of the second power to the first power. A correction unit corrects an output value of the photoelectric sensor using the second value.

In another aspect of the present invention, new independent claim 16 recites an exposure method of transferring a pattern of an original to a substrate using light supplied from a light source. According to the method, an amount of light supplied from the light source is detected using a photoelectric sensor used to control an amount of light to which the substrate is exposed. A first value for correcting an output value of the photoelectric sensor is stored in a memory with respect to each accumulated energy of light having a first power with which the photoelectric sensor is irradiated. A second value for correcting an output value of the photoelectric sensor corresponding to a second accumulated energy of light having a second power with which the photoelectric sensor is irradiated is calculated based on the first value in the memory

corresponding to the second accumulated energy, and a ratio of the second power to the first power, and an output value of the photoelectric sensor is corrected using the second value.

In Applicant's view, Nishi et al. discloses a scanning exposure type of projection exposure apparatus in which a reticle and a wafer are relatively scanned so that a pattern on the reticle is transferred onto the wafer by exposure. Heat exchangers which have Peltier devices are provided on a side surface of an integrator sensor which measures the quantity of exposure to control temperature of a photosensitive surface of the integrator sensor. In a side of heat irradiation surface of the heat exchangers, cooling water is circulated so that the heat exchangers are cooled. Saturation temperature at which temperature of the photosensitive surface is saturated when an illumination beam is irradiated to the photosensitive surface is determined and then the quantity of light irradiated to the photosensitive surface is measured with the temperature of the photosensitive surface being maintained at the saturation temperature. Based on the relation determined in advance between temperature of the photosensitive surface and the sensitivity of the integrator sensor at the saturation temperature, values of the quantity of light measured are corrected and then intensity of a light source is controlled by a main control system based on the corrected quantity of light.

According to the invention defined in new Claims 11 and 16, a memory stores a first value for correcting the output value of a photoelectric sensor with respect to each accumulated energy of light having a first power with which the photoelectric sensor is irradiated. A calculator calculates a second value that corrects the output value of the photoelectric sensor corresponding to a second accumulated energy of light having a second power with which the photoelectric sensor is irradiated based on the first value in the memory corresponding to the

second accumulated energy and the ratio of the second power to the first power. The second value is used by a correction unit to correct the output value of the photoelectric sensor.

Advantageously, no temperature sensor is required for correction calculation.

Nishi et al. may teach an exposure arrangement for measuring a quantity of light with temperature variations. As disclosed at lines 3-12 of column 19 of Nishi et al. "The exposure control system 20 is connected with a memory 21 which stores information such as scale factors used to determine the quantity of light (exposure per unit time) irradiated on the wafer W based on the output signal of the integrator sensor 33. In this embodiment, the output signal of the integrator sensor 33 is calibrated using, for example, a predetermined reference illuminometer, and the memory 21 further stores correction factors used to correct the output signal of the integrator sensor 33 based on the calibration results." As a result, it is not seen that memory 21 of Nishi et al. used solely for storing information such as scale factors or correction factors used to correct the signal of an integrator sensor 33 in any manner teaches or suggests the feature of Claims 11 and 16 of a memory that stores a first value for correcting the output value of a photoelectric sensor with respect to each accumulated energy of light having a first power with which the photoelectric sensor is irradiated.

It is a further feature of Claims 11 and 16 that a second value for correcting the output value of a photoelectric sensor corresponding to a second accumulated energy of light having a second power with which the photoelectric sensor is irradiated is calculated based on the first value stored in the memory corresponding to the second accumulated energy and the ratio of the second power to the first power. It is not seen that Nishi et al.'s arrangement wherein values of measured quantity of light are corrected based on the relation determined in advance between

temperature of the photosensitive surface and the sensitivity of the integrator sensor at the saturation temperature (Nishi et al. abstract) in any manner teaches or suggests calculating a corrected output value for a photoelectric sensor corresponding to a second accumulated energy of light having a second power irradiating the photoelectric sensor based on the memory stored first value for the second accumulated energy and the ratio of the second power to the first power. Accordingly, it is believed that new Claims 11 and 16 are completely distinguished from Nishi et al. and are allowable thereover.

In Applicant's opinion, Takahashi et al. discloses exposure apparatus that includes a light source for emitting exposure light. An illumination optical system illuminates an original on which a pattern is formed by the exposure light emitted from the light source. A projection optical system projects the pattern to a photosensitive object. A first photodetector, disposed in a portion for receiving light from an optical path between the light source and a portion where the original is placed, monitors an emission light amount from the light source, and a processing system. The processing system obtains information regarding light exposure provided to at least an optical element included in one of the illumination optical system and the projection optical system, estimates a change in transmittance of the optical element on the basis of the information obtained and corrects a proportional coefficient for the light amount detected by the first photodetector and the emission light amount from the light source on the basis of the estimated change of transmittance.

Takahashi et al. discloses exposure apparatus in which a transmittance change in the optical system of an illumination optical system 100 and a transmittance change in the projection optical system 10 are estimated. Based on the estimated transmittance changes, the sensitivities

of a light amount detector 12 and an irradiated light amount detector 13 as well as the relationship between the voltage to be applied to a light source 1 and the output of the light amount detector 12 are corrected. It one feature of Claims 11 and 16 that a memory stores a first value for correcting the output value of a photoelectric sensor with respect to each accumulated energy of light having a first power with which the photoelectric sensor is irradiated and another feature that the output value of a photoelectric sensor corresponding to a second accumulated energy of light having a second power with which the photoelectric sensor is irradiated is calculated based on the first value stored in the memory corresponding to the second accumulated energy and the ratio of the second power to the first power. It is not seen that Takahashi et al. in any way suggests these features of Claims 11 and 16.

With respect to the cited combination of Nishi et al. and Takahashi et al., neither of these references has any disclosure suggesting the feature of a memory stores a first value for correcting the output value of a photoelectric sensor with respect to each accumulated energy of light having a first power with which the photoelectric sensor is irradiated combined with the feature of the output value of a photoelectric sensor corresponding to a second accumulated energy of light having a second power with which the photoelectric sensor is irradiated being calculated based on the first value stored in the memory corresponding to the second accumulated energy and the ratio of the second power to the first power. As a result, it is not seen that the addition of Takahashi et al.'s estimation of transmittance changes in the optical system of an illumination optical system 100 and in the projection optical system 10 to correct the sensitivities of a light amount detector 12 and an irradiated light amount detector 13 as well as the relationship between the voltage to be applied to a light source 1 and the output of the light

amount detector 12 added to Nishi et al.'s correction of values of measured quantity of light based on the relation determined in advance between temperature of the photosensitive surface and the sensitivity of the integrator sensor at the saturation temperature with a memory that stores information such as scale factors or correction factors used to correct the signal of an integrator sensor could possibly suggest the features of Claims 11 and 16. Accordingly, it is believed that new Claims 11 and 16 are completely distinguished from any combination of Nishi et al. and Takahashi et al. and are allowable.

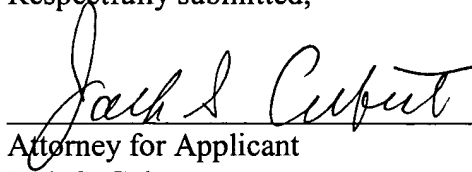
For the foregoing reasons, Applicant submits that the present invention, as recited in independent claims 11 and 16, is patentably defined over the cited art.

Dependent claims 12-15 and 17-19 also should be deemed allowable, in their own right, for defining other patentable features of the present invention in addition to those recited in their respective independent claims. Further individual consideration of these dependent claims is requested.

Applicant further submits that the instant application is in condition for allowance. Favorable consideration, withdrawal of the objections and rejection set forth in the above-noted Office Action and an early Notice of Allowance are requested.

Applicant's attorney, Steven E. Warner, may be reached in our Washington, D.C. office by telephone at (202) 530-1010 All correspondence should continue to be directed to our address given below.

Respectfully submitted,

A handwritten signature in cursive script, reading "Jack S. Cubert", is written over a horizontal line.

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